



TENNESSEE DEPARTMENT OF

EDUCATION
FIRST TO THE TOP

Forensic Science

Primary Career Cluster:	Health Science
Consultant:	Amy F. Howell, (615) 532-2839, Amy.F.Howell@tn.gov
Course Code(s):	5996
Prerequisite(s):	<i>Diagnostic Medicine</i> (5994)
Credit:	1
Grade Level:	11-12
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
Programs of Study and Sequence:	This is one of two capstone course options in the <i>Biotechnology Research</i> program of study.
Aligned Student Organization(s):	HOSA: http://www.tennesseehosa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit http://tn.gov/education/cte/work_based_learning.shtml .
Available Student Industry Certifications:	None
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	577, 720
Required Teacher Certifications/Training:	Teachers who have never taught Forensic Science MUST attend an 8 hour training provided by Department of Education.
Teacher Resources:	http://www.tn.gov/education/cte/HealthScience.shtml

Course Description

Forensic Science is a capstone course designed to draw key connections throughout biology, chemistry, genetics, anatomy, and physics in a setting that supports the criminal justice system. Upon completion of this course, proficient students will have a full understanding of the scope, development, and history of forensic science, the difference between biological and chemical forensics, and how science is used in law enforcement to solve crimes. In addition, students will continue to add artifacts to the portfolio begun in *Health Science Education*, reflecting the full range of activities undertaken in their program of

study. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Scientific Research, Anatomy and Physiology, Biology II, and Chemistry II.*

Program of Study Application

This is one of the capstone courses in the *Biotechnology Research* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

Course Standards

Scope and Development of Forensic Science

- 1) Define forensic science and explain the connection between science and law enforcement. Summarize the concepts of the eleven sections of forensic science as defined by the American Academy of Forensic Science. List a sample forensic science occupation that falls under each of the eleven sections. (TN Reading 2, 4, 9; TN Writing 8, 9)
- 2) Develop a career profile for at least three occupations identified from the previous standard, using print, online, and/or personal interview sources to capture at minimum the following:
 - a. Job description
 - b. Essential knowledge and skills needed for the career
 - c. Program or path of study to reach occupational goals, beginning with high school and proceeding through postsecondary
 - d. Licensure and credentialing requirements
 - e. Non-educational job requirements such as physical fitness tests, minimum age, and psychological evaluations
 - f. Role as an expert witness in courts
 - g. Specific evidence such professionals are responsible for, such as a forensic nurse assisting with gathering evidence for an alleged rape(TN Reading 1, 7; TN Writing 4, 9)
- 3) Articulate important historical events, contributors, and development of new or changing careers influencing the evolution of forensic science in the United States. Use a timeline or other graphic to illustrate the major developments from the 16th century to today, citing specific textual evidence from textbooks, online and print journals, and other websites. Include major legislation related to the practice of forensic science. (TN Reading 1, 2, 9, 7; TN Writing 2, 9)
- 4) Citing information found on the American Academy of Forensic Science website, news media, and legislation, describe the evolution of the modern crime laboratory. Discuss the features of present-day crime labs, including the differences between public and private labs. Explore how these features have changed expectations regarding lab services and capabilities, the new or emerging technologies they employ, or the impact on the conviction rates of criminals. (TN Reading 1, 7, 9; TN Writing 4, 7, 8, 9)
- 5) Research the Crime Scene Investigation (CSI) media phenomenon. Summarize the information from at least three peer-reviewed articles to develop claims and counterclaims about how the

so-called “CSI effect” has impacted forensic science, criminal investigations, and changes in legislation. (TN Reading 2, 9; TN Writing 1)

- 6) Evaluate the principles of the scientific method and relate their application to forensic science and crime lab procedures. Complete a literature review of at least three peer-reviewed articles concerning current and emerging scientific research in forensic science. Write persuasively on the merits of the research to determine if the methodologies used meet the criteria for rigor outlined in the scientific method. (TN Reading 1, 2, 4, 5, 6, 8; TN Writing 1, 7, 8, 9; TN Scientific Research 2, 3, 4)
- 7) Research the history of mapping, geographic information systems (GIS), global positioning systems (GPS), remote sensing, and other geospatial technologies. Examine how these technologies have evolved in the field of forensic science, evaluating their influence on present-day society and citing specific textual evidence from textbooks, online and print journals, and other websites. Detail how a range of forensic scientists use GIS technologies in their work. (TN Reading 2, 3, 4, 9; TN Writing 8, 9)
- 8) Classify examples of forensic evidence into types such as biological, chemical, impressions, and electronic evidence. From this list, generate an explanation of the analysis methods used for physical evidence, such as chromatography, gel electrophoresis, and/or serological analysis. Focusing on one piece of evidence, determine the correct analysis method, explain what kind of information the analysis will yield, and report on how the expected outcomes will contribute to an investigation. (TN Reading 4, 8; TN Writing 7, 8, 9; TN Scientific Research 3, 4, 5)
- 9) Define chain of custody, starting at the crime scene with collection of evidence until it arrives in a lab. Predict the legal ramifications if chain of custody is not maintained when handling evidence brought to a forensic lab. Explain any special circumstances in which it is appropriate and allowable for physical evidence to be released or destroyed. (TN Reading 2, 9; TN Writing 4)

Biological Forensics

- 10) Examine the differences in standard precautions, personal protective clothing, and personal protective equipment (PPE) in forensic labs as compared with other healthcare settings. Outline the steps one should take if exposure to hazardous or bloodborne pathogens occurs. Demonstrate donning and doffing all PPE and care of soiled equipment or vehicles. (TN Reading 2, 3, 4; TN Writing 9)
- 11) Differentiate between the careers of forensic anthropology and forensic odontology by reviewing case studies or viewing simulated remains in a laboratory setting. Explain the scientific processes involved in identifying remains to determine if they are human or nonhuman, and what occurs during a skeletal comparison to determine sex, ancestry, and age. Evaluate dental records or x-rays and identify normal and abnormal dental findings. Document findings from both evaluations using industry-acceptable terminology. (TN Reading 1, 2, 8; TN Writing 4; TN A&P 2)
- 12) Document a biological profile of remains. Note skin coloration, types of skeletal trauma, presence of defensive wounds or other visible marks, stage of decomposition, entomological activity, environmental factors, rigor mortis, and post-mortem lividity. Include results that could

be gathered by a forensic pathologist, forensic anthropologist, forensic radiologist, forensic dentist, coroner, or law enforcement. (TN Reading 4, 8; TN Writing 2, 4, 7, 8, 9; TN A&P 2, TN Biology II 2)

- 13) Interpret the findings of an autopsy report found from public records or online resources. Summarize the components that are typically included in an autopsy report; then relate findings to normal anatomy and physiology of the system involved. Describe the responsibilities of a medical examiner in the development of an autopsy, and report on how recent court cases have been influenced by official autopsy reports. (TN Reading 1, 2, 4; TN Writing 4, 7, 9; TN A&P 1, 2, 4)
- 14) Perform analysis on samples of hair to identify the normal morphology. Using scientific terminology and citation conventions to reference sources, explain the identification and comparison procedures used in crime labs to determine if a sample is natural human hair, manufactured hair, or animal hair. (TN Reading 3, 4; TN A&P 2)
- 15) Summarize in a graphic illustration the forensic tests performed on body fluids to determine their type. Include at least the following tests: color test, microcrystalline test, precipitin test, and gel diffusion. Explain the differences in antibodies and antigens, their relationships to blood typing, and immunoassay techniques. Perform blood typing procedures using simulated blood as well as other forensic tests as allowed by available equipment. (TN Reading 4, 9; TN Writing 4, 9; TN A&P 2, 3; TN Chemistry II 3)
- 16) Explain in a written, digital, or oral presentation basic components and concepts related to DNA. Include a definition of DNA, its chief characteristics and structure, and the features of a double helix. Compare and contrast the methods of DNA analysis, such as polymerase chain reaction (PCR), restriction fragment length polymorphisms (RFLPs), and short tandem repeats (STR). Identify the advantages and disadvantages for each, their specific uses in forensics, as well as any limitations. Practice DNA analysis in a classroom or laboratory setting. (TN Reading 1, 2, 3, 4, 7, 8; TN Writing 4, 9; TN Biology II 4, 5, 6)
- 17) Debate how DNA testing and the Combined DNA Index System (CODIS) have changed the criminal justice system, citing evidence from professional print or digital journals, case studies, court cases, or interviews with law enforcement or forensic scientists to develop claims and counterclaims. (TN Reading 1, 2, 9; TN Writing 1, 4, 9, TN Biology II 5)
- 18) Conduct a short research project to analyze fingerprint samples. Provide a synopsis of research findings to explain the following: ridge characteristics, underlying anatomy of fingerprint development, and fingerprint classes based on patterns. Explain how fingerprinting and the Automated Fingerprint Identification System (AFIS) have changed the criminal justice system, citing evidence from professional print or digital journals, case studies, court cases, or interviews with law enforcement or forensic scientists to justify claims. (TN Reading 1, 2, 4, 8, 9; TN Writing 7; TN Scientific Research 2, 3, 4, TN A&P 2)
- 19) Review case studies or case files to identify physiological and psychological factors related to criminal behavior. Relate normal anatomy and physiology with abnormal findings retrieved from literature. (TN Reading 1, 2, 7; TN Writing 7; TN Scientific Research 4; TN A&P 3)

Chemical Forensics

- 20) Evaluate case studies or case files related to toxicological incidents. Apply analysis of these texts to explain the laboratory tests performed to identify drugs, alcohol, and other toxicology agents. Describe in lab or classroom the theories and scientific processes related to each test. Discuss the techniques that are specifically used in toxicology and what the findings of each test signify. (TN Reading 1, 2, 7; TN Writing 4, 9; TN Scientific Research 4; TN Chemistry II 3)
- 21) Identify the types of drugs that might be found in victims and/or suspects during a criminal investigation. Research and explain gas chromatography, thin-layer chromatography, mass spectrometry, ultraviolet, and infrared spectroscopy methods for identifying legal and illegal drugs. Given a case study involving drugs, select the type of laboratory analysis that would yield the appropriate information. Justify the selection with information cited from textbooks, online and print journals, and precedents identified from similar cases. (TN Reading 2, 4, 7; TN Writing 4, 5, 7; TN Chemistry II 3)
- 22) Investigate the science surrounding the physical properties of matter, and explain how they are related to the forensic analysis of glass, fibers, metals, and/or paints. Apply the principles of temperature, weight and mass, density, and the refractive index in the context of forensic science. (TN Reading 2, 3, 4; TN Writing 4; TN Scientific Research 3; TN Chemistry II 2)
- 23) Explain the scientific basis for identifying the presence of gunpowder residue on objects, victims, and suspects; similarly, explain how scientists identify impressions on the victim or those who have left a crime scene. Include in the explanation how to determine bullet caliber from a wound in a victim. Review cases that have been decided based on impressions and ballistic evidence, and relate how forensic science was involved. (TN Reading 2, 3, 4, 8; TN Writing 2, 7, 8, 9; TN Scientific Research 2, 3, 4, 5; TN Chemistry II 3)

Portfolio

- 24) Update the portfolio started in *Health Science Education* to demonstrate mastery of skills and knowledge acquired throughout the full Biotechnology Research program of study and applied in the final course. The portfolio should reflect thoughtful assessment and evaluation of the progression of work, exhibiting personal and professional growth in the health science pathway. (TN Writing 4, 5, 6)

The following artifacts will reside in the student portfolio:

- Career Exploration portfolio
- Skills performance rubrics
- Documentation of job shadowing hours
- Examples of written, oral, or digital presentations
- Short research project documents

Standards Alignment Notes

*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
 - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
 - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Scientific Research: Tennessee Science: [Scientific Research](#) standards 2, 3, 4, and 5 may provide additional insight and activities for educators.
- TN A&P: Tennessee Science: [Anatomy and Physiology](#) standards 1, 2, 3, and 4 may provide additional insight and activities for educators.
- TN Biology II: Tennessee Science: [Biology II](#) standards 2, 4, and 5 may provide additional insight and activities for educators.
- TN Chemistry II: Tennessee Science: [Chemistry II](#) standards 2 and 3 may provide additional insight and activities for educators.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
 - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.